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9 PagesPROGRESS REPORT - 12/15/60 - 1/15/61CONTRACT No. AF 33(600)40280SYNCHRONIZER

The binary counter section of the 13 stage transistorized bread board unit has been completed and checked out. The diode logic units have also been assembled and checked out.

Forty 2N706 transistors have been checked to the better 2N706A specification and are ready for use in a later printed circuit prototype. Ten 2N726 transistors have also been approved for use in both breadboard and prototype. Delivery has not been made on 2N834 units so work has gone ahead by substituting 2N706's.

Work continues on the development of logic gate circuitry.

Driving the 50 ohm lines to recorder may also present problems.

Purchase orders for one breadboard and two prototype 13 megacycle oscillator units for the synchronizer at a cost of \$995.00 have been issued, (1-16-61).

The expected platform perturbation could not be established except by judgment. On attached sketch I curve A shows minimum tolerable acceleration level. Curves B,C,D,E,F are information from which the expected perturbation curve G, was estimated. It would appear compensation can be accomplished by frequency deviating the phase detector reference frequencies. Scale factors and compensation signal sources are being investigated.

FREQUENCY GENERATOR

Tests to date indicate the reactance tube modulator approach to frequency stability in the closed loop system seems to be limited to a deviation of 2%. A new approach using varicaps is being set up. No data

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on this method has been collected to date.

#### STALO

Slow frequency deviations between the two borrowed STALO units in the laboratory still exceed the deviation limit as required by the system by a considerable amount. An increase in loop gain under 100 cps modulating frequency is being considered. No change in physical dimensions is anticipated.

#### KLYSTRON AMPLIFIER

Two VA401 klystron amplifiers have been ordered from Varian.

#### NAVIGATION TIE-IN

A design using a second resolver which is angularly aligned with the drift resolver by means of a servo has been worked out. A potentiometer is also coupled to the motor-gearbox combination which drives the second resolver. This unit would be used instead of the 400 cycle amplifier phase detector combination. A second resolver and a motor gear combination has been obtained.

#### CRYSTAL MODULATOR

A breadboard unit has been built and is now being checked for power output for a given power input and carrier suppression. The anticipated conversion loss is approximately 15 db due to the efficiency of crystals working at an input power on the order of 100 mw.

25X1

has proposed a modulator using varactor diodes instead of crystals. The conversion loss would be about 7-8 db.

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RECEIVER

Two traveling wave tubes were ordered per PDS-21094 Rev. A and General Electric Company Warranty DS-500 and a test specification for tube started.

Due to the inherent ON-OFF times of the resonant ring dump switch any reflected power due to shorts (arcing) in the waveguide will not be reflected directly toward the TWT. Reflected power will traverse the ring proper, suffering attenuation and coupling loss, during the time the switch is still ionized. When switch is de-ionized, energy will travel toward TWT, but arcing will not occur. Due to the shortness of this pulse, TR tube protection would not be usable. Since it is highly improbable that arc will occur, even under the most advantageous conditions, it is not deemed necessary to take any special precautions in protecting the TWT from this fault.

Receiver Parameters

The bandwidth of the video amplifier is being increased to 60 mc in order to reduce the overshoot from 8% to 1%.

Circuit design to date is as follows:

Synchronous Detector - Two circuits (pentode and triode) were breadboarded and tested. Neither circuit was satisfactory in that leakage signals were greater than the desired signal. More work will be done. In the meantime, a ring modulator circuit will be built and tested.

IF Amplifier - A detailed design circuit is held up pending a successful synchronous detector.

Video Amplifier - A distributed amplifier design has been in progress and breadboarding should start during the next reporting period.

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#### POWER SUPPLY

A quote was received from Components Section. This quote was considered to be too high. Thus R-1806, Descriptive Specification, and SK-G3-S6-0025, Power Flow Diagram, were revised and R-1813, a more detailed descriptive specification for subcontracting purposes, was written. New quotes will be obtained from the components section and outside suppliers, with the aid of the above specifications. A list has been made stating the items that should be monitored on the control panel.

The components section has been authorized to design and develop the step motor servo transformer.

A turn-on procedure has been written for the system explaining the sequence of operation, when the system is energized.

#### MODULATOR

A manufacturer was found who had previously built the PFN and pulse transformer for a modulator driving a V24B klystron. The rise time and pulse top flatness were better than required in the present application. A special technique was used which incorporated the inductance of the pulse transformer and the load capacity as a part of the PFN. Since it appeared that this manufacturer was qualified to build the critical parts required to allow the use of a line type modulator, a purchase request was issued and the use of a line type modulator decided on.

By the end of the period the design and rough layout were completed and submitted to drafting. Construction of a breadboard was started. No tests can be performed until the major components are received.

#### RESONANT RING

CORRECTION: Page 5 Report 11/15/60 - 12/15/60. Output pulse width,

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stated to be 16 usec, should be 16 nanosec.

A higher power modulator, using a 4J50 tube, has been obtained, and is being used to charge the SEI ring. H. P. Sampling Scope has been received, and is being used. Trouble was encountered with (1) hash (2) 1/3 height waveguide switch. Back tracking now being done to determine source of problem.

Drafting started on layout of finalized version of resonant ring. End result to be control drawing for completed PDS on resonant ring.

Design of directional couplings, power monitors, etc., for use with ring was begun and progressing satisfactorily.

#### SWITCH TUBES

The design approach to development of this tube is to investigate very low pressure (less than 1 mm of Hg pressure) gas discharge devices. The major characteristics to be determined initially are the power hold-off capability and triggering response times. Toward this end, a resonant ring circuit has been assembled which is capable of delivering one megawatt peak power and a sampling scope has been obtained for measurement of the triggering speeds. A vacuum-gas filling station has been completed and is presently being modified by the installation of vacuum gauges suitable for measuring the very low pressures involved.

A test cell, or tube, has been constructed which consists of a shorted section of waveguide one-quarter wavelength long with a mica pressure window at the open end. Data taken this past week of breakdown power vs pressure indicated that for air as the gas one megawatt of power could be held off below a pressure of 1 micron. These tests were mainly to check out instrumentation. When the modification to the gas fill system is completed, additional tests will be made for other gases or combinations.

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As outlined in a proposed schedule submitted to Surveillance Radar, two approaches to obtaining fast triggering will be tried. One involves triggering by electrostatic means and the other by magnetic field. Test cells for the two approaches are presently being built.

### ANTENNA

#### Electrical

Manifold - It was found that small phase errors occur due to the varying septum positions. The phase error in any manifold can be minimized by properly choosing the guide wavelength. To keep the manifold widths constant, the proper guide wavelength for each manifold was calculated and the average guide wavelength was used to obtain the phases at each stick. This data was submitted to the computers for analysis of the azimuth secondary pattern. This analysis indicates a 3 db beamwidth of  $\approx .56^\circ$ ; maximum sidelobe level of 22.44 db in the region  $0^\circ$  to  $\pm 2^\circ$ ; 26.2 db in the  $\pm 2^\circ$  to  $\pm 4.3^\circ$  region; and 34.2 db in the  $\pm 4.3^\circ$  to  $\pm 6^\circ$  region.

The individual manifold designs are now three; 1, 4, 5 being the same and 2 and 7, and 3 and 6 being the same. The step approximations to the Taylor curve are as follows: 2 steps in manifolds 1, 4, 5 and 8, and 4 steps in 2, 3, 6, and 7.

Array - Testing of sample sticks was delayed by lack of a testing site and was initiated on 1-13-61. These tests will be completed by 1-19-61.

Results of computations on the effects of mechanical bending of the array assembly have led to an increase in structural strength by using thicker honeycomb. The approximate support positions for minimum distortion have been found and computations for smaller support position increments in the optimum region are now under way.

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Initial evaluation of the effect of antenna height upon the requirements indicated that this dimension might be materially reduced without seriously affecting the electrical proper ties. Since the weight of the antenna is quite evenly distributed the weight reduction would be roughly proportionate to the reduction in height.

Computations for the synthesis of an  $11" \text{ CSC}^2 \theta \text{ Cos}^{\frac{1}{2}} \theta$  array (Woodward type synthesis) were completed on 1-13-61 and are presently being evaluated by the project section. Further action on this phase of the design is dependent upon the results of this evaluation.

Load Design - Several load samples are now ready for high temperature tests and a suitable heat source has been located. This source is expected to be available within a few days.

Radome - Samples for the sealing radome have been received. Because of their physical configuration a method for measuring their dielectric constants must be devised.

Samples for the cover radome are also available and power transmission tests are now under way. These tests will be completed by 1-18-61.

#### Mechanical

Structure Analysis - A honeycomb beam was designed as the mounting support structure of the antenna. A sketch of this structure is available for approval of mounting points and outlined dimensions but is being held pending decision concerning the final antenna height. Discussions with some prospective suppliers have taken place and invitations for discussions have been sent to several other leading suppliers. The first rough costs were estimated to be in the order of \$5,000 for each panel.

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Manifold Design - Electroforming appears to be a logical and practical method by which the manifold can be fabricated. This process is preferred because it will eliminate the need for brazing, thus preventing the probable distortion that would be caused by the high brazing temperatures. Also, the electrical surfaces could be gold plated during the course of manufacture and not as a separate operation. The approximate cost, as proposed by Gar Precision Products Company, will be \$300 for tooling plus \$235 per unit. The miters and transitions would cost \$75 for tooling plus \$42.50 per unit for each of 384 units. Two additional electro-forming companies have been invited to Air Arm to discuss the manifold and make a quote.

Array Design and Power Dividers - A proposal to electro-form the array sticks has been received and it appears that the cost of electro-forming complete almost equals the cost of making the sticks by other means plus the additional machining, material and mounting facilities costs. Effort to obtain a reasonable cost estimate for cutting the slots by the electrical discharge method have been unsuccessful to date but are being continued.

Tolerance Study - Computer results indicated that the 1-1/4" thick honeycomb structure would allow deflections of its beam that caused a deterioration of RF performance. A second run was made and preliminary examination of results indicates much improvement in using a 1.45" thick honeycomb structure. These results will be fully analyzed before further action is taken.

Radome Design - Samples of several adhesives and laminates have been received and are currently undergoing heat aging tests to eliminate

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any that will not withstand the thermal conditions. Thermal shock (between 550°F and -65°F) and adhesion tests are scheduled to take place after completion of Aging Tests.

Radome Tests - An erosion test has been initiated to determine the rate of erosion that can be expected. Test pieces to heat and pressure test seals have been started.

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K&E LOGARITHMIC 300-1200  
KEUFFEL & ESSER CO. MADE IN U.S.A.  
3 X 3 CYCLES

- A ACCEL REQUIREMENTS
- B MIL-E-5272 PROC II
- C MIL-E-5272 PROC XIV
- D LOW ALT. - DEAD CALM
- E LOW ALT. - TURBULENT-STORMY
- F MEAN BETWEEN D & E
- G EXPECTED A/C ACCELERATIONS

